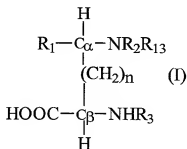


What is claimed is:

1. A non-natural amino acid compound of the formula I:



wherein

n is an integer of from 2 to 4;

R₁, R₂, R₃ and R₁₃ are, independently, hydrogen or lower branched or straight chain alkyl, alkenyl or alkynyl of C₁-C₅; and

C_α and C_β are carbon atoms and the stereochemistry at C_α and C_β is, independently, either R or S;

or the ester or salt thereof, wherein

when R₁, R₂, R₃ and R₁₃ are all hydrogen, then n is not 2 or 3,

when n is 2 or 3, R₁ and R₁₃ are hydrogen, and R₂ and R₃ are independently hydrogen or methyl with at least one of R₂ and R₃ being methyl, then the stereochemistry at C_β is not S, and

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when n is 4, and R_1 , R_2 , R_3 and R_{13} are all hydrogen, then the stereochemistry at C_β is not R.

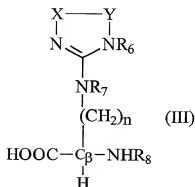
2. The compound of claim 1, wherein R_1 , R_2 , R_3 and R_{13} are, independently, hydrogen or methyl.
3. The compound of claim 2, wherein n is 4.
4. The compound of claim 1, wherein
 - a) n is 4, R_1 , R_3 and R_{13} are hydrogen, R_2 is methyl, the compound of formula I is an acid, and the stereochemistry at C_β is R;
 - b) n is 4, R_1 , R_3 and R_{13} are hydrogen, R_2 is methyl, the compound of formula I is an acid, and the stereochemistry at C_β is S;
 - c) n is 4, R_1 and R_2 are methyl, R_3 and R_{13} are hydrogen, the compound of formula I is an acid, the stereochemistry at C_α is R, and the stereochemistry at C_β is R;
 - d) n is 4, R_1 and R_2 are methyl, R_3 and R_{13} are hydrogen, the compound of formula I is an acid, the stereochemistry at C_α is S, and the stereochemistry at C_β is R;
 - e) n is 4, R_1 and R_2 are methyl, R_3 and R_{13} are hydrogen, the compound of formula I is an acid, the stereochemistry at C_α is R, and the stereochemistry at C_β is S;

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- f) n is 4, R_1 and R_2 are methyl, R_3 and R_{13} is hydrogen, the compound of formula I is an acid, the stereochemistry at C_α is S, and the stereochemistry at C_β is S;
- g) n is 4, R_1 is methyl, R_2 , R_3 and R_{13} are hydrogen, the compound of formula I is an acid, the stereochemistry at C_α is R, and the stereochemistry at C_β is R;
- h) n is 4, R_1 is methyl, R_2 , R_3 and R_{13} are hydrogen, the compound of formula I is an acid, the stereochemistry at C_α is S, and the stereochemistry at C_β is R;
- i) n is 4, R_1 is methyl, R_2 , R_3 and R_{13} are hydrogen, the compound of formula I is an acid, the stereochemistry at C_α is R, and the stereochemistry at C_β is S;
- j) n is 4, R_1 is methyl, R_2 , R_3 and R_{13} are hydrogen, the compound of formula I is an acid, the stereochemistry at C_α is S, and the stereochemistry at C_β is S;
- k) n is 4, R_1 , R_2 , R_3 and R_{13} are hydrogen, the compound of formula I is an acid, and the stereochemistry at C_β is S;

or the salt or ester thereof.

5. A non-natural amino acid compound of the formula III:



wherein

n is an integer of from 2 to 4;

X-Y is $(\text{CH}_2)_z$, wherein z is an integer of from 2 to 4;

R_6 , R_7 and R_8 are, independently, hydrogen or lower branched or straight chain alkyl, alkenyl or alkynyl of $\text{C}_1\text{-C}_5$, wherein R_6 is not hydrogen; and

C_β is a carbon atom and the stereochemistry at C_β is either R or S;

or the ester or salt thereof.

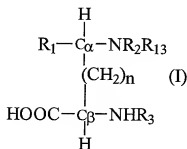
6. The compound of claim 5, wherein z is 2 or 3.
7. The compound of claim 5, wherein n is 3.
8. A peptide comprising the non-natural amino acid of claim 1.
9. A peptide comprising the non-natural amino acid of claim 5.

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10. A method for screening a peptide for an activity, comprising the steps of:

a) measuring an activity of a peptide having a selected amino acid sequence and comprising a natural amino acid;

b) measuring the same activity of a peptide having the same amino acid sequence but substituted independently in place of at least one natural amino acid, is a non-natural amino acid having the formula I or III:



wherein

n is an integer of from 2 to 4;

R₁, R₂, R₃ and R₁₃ are, independently, hydrogen or lower branched or straight chain alkyl, alkenyl or alkynyl of C₁-C₅; and

C_α and C_β are carbon atoms and the stereochemistry at C_α and C_β is, independently, either R or S;

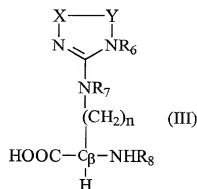
or the ester or salt thereof, wherein

when R₁, R₂, R₃ and R₁₃ are all hydrogen, then n is not 2 or 3,

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when n is 2 or 3, R_1 and R_{13} are hydrogen, and R_2 and R_3 are independently hydrogen or methyl with at least one of R_2 and R_3 being methyl, then the stereochemistry at C_β is not S , and

when n is 4, and R_1 , R_2 , R_3 and R_{13} are all hydrogen, then the stereochemistry at C_β is not R ; or



wherein

n is an integer of from 2 to 4;

X-Y is $(\text{CH}_2)_z$, wherein z is an integer of from 2 to 4;

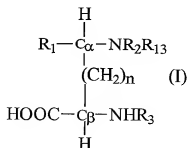
R_6 , R_7 and R_8 are, independently, hydrogen or lower branched or straight chain alkyl, alkenyl or alkynyl of $\text{C}_1\text{--C}_5$; and

C_β is a carbon atom and the stereochemistry at C_β is either R or S ;

or the ester or salt thereof.

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11. The method of claim 10, wherein the peptide of step a) consists of natural amino acids.
12. The method of claim 10, wherein the non-natural amino acid is substituted for the comparable at least one natural amino acid of lysine and/or arginine.
13. The method of claim 12, wherein the activity is a pharmacological activity of half-life, solubility, or stability.
14. A method of treating or preventing in a subject a disease treated or prevented by the administration of a peptide, comprising administering to the subject a peptide having, substituted for a natural amino acid, at least one non-natural amino acid having the following formula I or III:



wherein

n is an integer of from 2 to 4;

R₁, R₂, R₃ and R₁₃ are, independently, hydrogen or lower branched or straight chain alkyl, alkenyl or alkynyl of C₁-C₅; and

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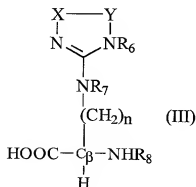
C_α and C_β are carbon atoms and the stereochemistry at C_α and C_β is, independently, either R or S;

or the ester or salt thereof, wherein

when R_1 , R_2 , R_3 and R_{13} are all hydrogen, then n is not 2 or 3,

when n is 2 or 3, R_1 and R_{13} are hydrogen, and R_2 and R_3 are independently hydrogen or methyl with at least one of R_2 and R_3 being methyl, then the stereochemistry at C_β is not S, and

when n is 4, and R_1 , R_2 , R_3 and R_{13} are all hydrogen, then the stereochemistry at C_β is not R; or



wherein

n is an integer of from 2 to 4;

X-Y is $(\text{CH}_2)_z$ wherein z is an integer of from 2 to 4;

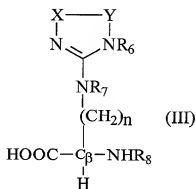
R_6 , R_7 and R_8 are, independently, hydrogen or lower branched or straight chain alkyl, alkenyl or alkynyl of C_1 - C_5 , wherein R_6 is not hydrogen; and

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C_β is a carbon atom and the stereochemistry at C_β is either R or S;

or the ester or salt thereof.

15. The method of claim 14, wherein the natural amino acid is lysine and/or arginine.
16. A method of treating or preventing in a subject a disease treated or prevented by the administration of a peptide, comprising administering to the subject a peptide having, substituted for a natural amino acid, at least one non-natural amino acid having the following formula III:



wherein

n is an integer of from 2 to 4;

X-Y is $(\text{CH}_2)_z$, wherein z is an integer of from 2 to 4;

R_6 , R_7 , and R_8 are, independently, hydrogen or lower branched or straight chain alkyl, alkenyl or alkynyl of C_1 - C_5 ; and

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C_β is a carbon atom and the stereochemistry at C_β is either R or S;

or the ester or salt thereof,

wherein the peptide is not luteinizing hormone and releasing hormone or an analog thereof.

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